

What is claimed is:

1. An isolated nucleic acid molecule comprising a nucleotide sequence that encodes a toxin that is active against insects, wherein said nucleotide sequence:
 - (a) has a complement that hybridizes to nucleotides 1981-2367 of SEQ ID NO: 1 in 7% sodium dodecyl sulfate (SDS), 0.5 M NaPO₄, 1 mM EDTA at 50°C. with washing in 0.1XSSC, 0.1% SDS at 65°C.; or
 - (b) is isocoding with the nucleotide sequence of (a); or
 - (c) has at least 93% sequence identity with SEQ ID NO: 1; or
 - (d) encodes an amino acid sequence having at least 91% sequence identity with SEQ ID NO: 2.
2. The isolated nucleic acid molecule according to claim 1, wherein said nucleotide sequence has a complement that hybridizes to nucleotides 1981-2367 of SEQ ID NO: 1 in 7% sodium dodecyl sulfate (SDS), 0.5 M NaPO₄, 1 mM EDTA at 50°C. with washing in 0.1XSSC, 0.1% SDS at 65°C.
3. The isolated nucleic acid molecule according to claim 1, wherein said nucleotide sequence is isocoding with a nucleotide sequence having a complement that hybridizes to nucleotides 1981-2367 of SEQ ID NO: 1 in 7% sodium dodecyl sulfate (SDS), 0.5 M NaPO₄, 1 mM EDTA at 50°C. with washing in 0.1XSSC, 0.1% SDS at 65°C.
4. The isolated nucleic acid molecule according to claim 1 comprising a nucleotide sequence that has at least 75% sequence identity with nucleotides 1981-2367 of SEQ ID NO: 1.
5. The isolated nucleic acid molecule according to claim 1 comprising a nucleotide sequence that has at least 85% sequence identity with nucleotides 1981-2367 of SEQ ID NO: 1.

6. The isolated nucleic acid molecule according to claim 1 comprising a nucleotide sequence that has at least 95% sequence identity with nucleotides 1981-2367 of SEQ ID NO: 1.
7. The isolated nucleic acid molecule according to claim 1 comprising a nucleotide sequence that has at least 99% sequence identity with nucleotides 1981-2367 of SEQ ID NO: 1.
8. The isolated nucleic acid molecule according to claim 1 comprising nucleotides 1981-2367 of SEQ ID NO: 1 or SEQ ID NO: 3.
9. The isolated nucleic acid molecule according to claim 1, wherein said nucleotide sequence has at least 93% sequence identity with SEQ ID NO: 1.
10. The isolated nucleic acid molecule according to claim 1, wherein said nucleotide sequence has at least 95% sequence identity with SEQ ID NO: 1.
11. The isolated nucleic acid molecule according to claim 1, wherein said nucleotide sequence has at least 99% sequence identity with SEQ ID NO: 1.
12. The isolated nucleic acid molecule according to claim 1 comprising the nucleotide sequence set forth in SEQ ID NO: 1, SEQ ID NO: 3, SEQ ID NO: 11, SEQ ID NO: 32 or SEQ ID NO: 34.
13. The isolated nucleic acid molecule according to claim 1 comprising the nucleotide sequence of SEQ ID NO: 1.
14. The isolated nucleic acid molecule according to claim 1 comprising the nucleotide sequence of SEQ ID NO: 3.
15. The isolated nucleic acid molecule according to claim 1 comprising the nucleotide sequence of SEQ ID NO: 11.

16. The isolated nucleic acid molecule according to claim 1 comprising the nucleotide sequence of SEQ ID NO: 32.
17. The isolated nucleic acid molecule according to claim 1 comprising the nucleotide sequence of SEQ ID NO: 34.
18. The isolated nucleic acid molecule according to claim 1, wherein said nucleotide sequence encodes an amino acid sequence which has at least 91% identity to SEQ ID NO: 2.
19. The isolated nucleic acid molecule according to claim 1, wherein said nucleotide sequence encodes an amino acid sequence which has at least 95% identity to SEQ ID NO: 2.
20. The isolated nucleic acid molecule according to claim 1, wherein said nucleotide sequence encodes an amino acid sequence which has at least 99% identity to SEQ ID NO: 2.
21. The isolated nucleic acid molecule according to claim 1, wherein said nucleotide sequence encodes the amino acid sequence set forth in SEQ ID NO: 2, SEQ ID NO: 12, or SEQ ID NO: 33.
22. The isolated nucleic acid molecule according to claim 1, wherein said nucleotide sequence encodes the amino acid sequence set forth in SEQ ID NO: 2.
23. The isolated nucleic acid molecule according to claim 1, wherein said nucleotide sequence encodes the amino acid sequence set forth in SEQ ID NO: 12.
24. The isolated nucleic acid molecule according to claim 1, wherein said nucleotide sequence encodes the amino acid sequence set forth in SEQ ID NO: 33.

25. The isolated nucleic acid molecule according to claim 1 which is comprised in a *Bacillus thuringiensis* isolate selected from the group consisting of C1674, designated NRRL accession B-30556; and C536, designated NRRL accession B-30557.
26. The isolated nucleic acid molecule according to claim 1 which comprises the approximately 2.4 kb DNA fragment comprised in an *E. coli* clone selected from the group consisting of pNOV3910, designated NRRL accession B-30553; pNOV3911, designated NRRL accession B-30552; pNOV3906, designated NRRL accession B-30555; pNOV3905, designated NRRL accession B-30554; and pNOV3912, designated NRRL accession B-30551.
27. The isolated nucleic acid molecule according to claim 1 which comprises the approximately 2.4 kb DNA fragment comprised in *E. coli* clone pNOV3910, designated NRRL accession B-30553.
28. The isolated nucleic acid molecule according to claim 1 which comprises the approximately 2.4 kb DNA fragment comprised in *E. coli* clone pNOV3911, designated NRRL accession B-30552.
29. The isolated nucleic acid molecule according to claim 1 which comprises the approximately 2.4 kb DNA fragment comprised in *E. coli* clone pNOV3906, designated NRRL accession B-30555.
30. The isolated nucleic acid molecule according to claim 1 which comprises the approximately 2.4 kb DNA fragment comprised in *E. coli* clone pNOV3905, designated NRRL accession B-30554.
31. The isolated nucleic acid molecule according to claim 1 which comprises the approximately 2.4 kb DNA fragment comprised in *E. coli* clone pNOV3912, designated NRRL accession B-30551.

32. The isolated nucleic acid molecule according to claim 1, wherein said toxin comprises an amino acid sequence with at least 75% identity with amino acids 681-788 of the amino acid sequence of SEQ ID NO: 2.
33. The isolated nucleic acid molecule according to claim 1, wherein said toxin comprises an amino acid sequence which has at least 85% identity with amino acids 681-788 of the amino acid sequence of SEQ ID NO: 2.
34. The isolated nucleic acid molecule according to claim 1, wherein said toxin comprises an amino acid sequence which has at least 95% identity with amino acids 681-788 of the amino acid sequence of SEQ ID NO: 2.
35. The isolated nucleic acid molecule according to claim 1, wherein said toxin comprises an amino acid sequence which has at least 99% identity with amino acids 681-788 of the amino acid sequence of SEQ ID NO: 2.
36. The isolated nucleic acid molecule according to claim 1, wherein said toxin comprises amino acids 681-788 of the amino acid sequence of SEQ ID NO: 2.
37. The isolated nucleic acid molecule according to claim 1, wherein said toxin is active against a lepidopteran insect.
38. The isolated nucleic acid molecule according to claim 37, wherein said lepidopteran insect is selected from the group consisting of: *Ostrinia nubilalis* (European corn borer), *Plutella xylostella* (diamondback moth), *Spodoptera frugiperda* (fall armyworm), *Agrotis ipsilon* (black cutworm), *Helicoverpa zea* (corn earworm), *Heliothis virescens* (tobacco budworm), *Spodoptera exigua* (beet armyworm), *Pectinophora gossypiella* (pink boll worm), *Trichoplusia ni* (cabbage looper), *Cochyles hospes* (banded sunflower moth), and *Homoeosoma electellum* (sunflower head moth).
39. A chimeric gene comprising a heterologous promoter sequence operatively linked to the nucleic acid molecule of claim 1.

40. A recombinant vector comprising the chimeric gene of claim 39.
41. A transgenic host cell comprising the chimeric gene of claim 39.
42. The transgenic host cell according to claim 41, which is a bacterial cell.
43. The transgenic host cell according to claim 41, which is a plant cell.
44. A transgenic plant comprising the transgenic plant cell of claim 43.
45. The transgenic plant according to claim 44, wherein said plant is selected from the group consisting of sorghum, wheat, sunflower, tomato, cole crops, cotton, rice, soybean, sugar beet, sugarcane, tobacco, barley, oilseed rape and maize.
46. The transgenic plant according to claim 45, wherein said plant is a maize plant.
47. Transgenic seed from the transgenic plant of claim 44.
48. Transgenic seed from the maize plant of claim 46.
49. An isolated toxin that is active against insects, wherein said toxin comprises an amino acid sequence that:
 - a) has at least 75% identity with amino acids 661-788 of SEQ ID NO: 2; or
 - b) has at least 91% identity with SEQ ID NO: 2; or
 - c) is produced by the expression of a nucleic acid molecule comprising a nucleotide sequence that has a complement that hybridizes to nucleotides 1981-2367 of SEQ ID NO: 1 in 7% sodium dodecyl sulfate (SDS), 0.5 M NaPO₄, 1 mM EDTA at 50°C. with washing in 0.1XSSC, 0.1% SDS at 65°C.; or
 - d) is produced by the expression of a nucleic acid molecule comprising a nucleotide sequence that is isocoding with the nucleotide sequence of (c); or

e) is produced by the expression of a nucleic acid molecule comprising a nucleotide sequence that has at least 93% sequence identity with SEQ ID NO:

1.

50. The isolated toxin according to claim 49, wherein said toxin comprises an amino acid sequence which has at least 75% identity with amino acids 661-788 of the amino acid sequence of SEQ ID NO: 2.

51. The isolated toxin according to claim 49 comprising an amino acid sequence which has at least 85% identity with amino acids 661-788 of the amino acid sequence of SEQ ID NO: 2.

52. The isolated toxin according to claim 49 comprising an amino acid sequence which has at least 95% identity with amino acids 661-788 of the amino acid sequence of SEQ ID NO: 2.

53. The isolated toxin according to claim 49 comprising an amino acid sequence which has at least 99% identity with amino acids 661-788 of the amino acid sequence of SEQ ID NO: 2.

54. The isolated toxin according to claim 49 comprising amino acids 661-788 of the amino acid sequences set forth in SEQ ID NO: 2.

55. The isolated toxin according to claim 49 comprising an amino acid sequence which has at least 91% identity with the amino acid sequence set forth in SEQ ID NO: 2.

56. The isolated toxin according to claim 49 comprising an amino acid sequence which has at least 95% identity with the amino acid sequence set forth in SEQ ID NO: 2.

57. The isolated toxin according to claim 49 comprising an amino acid sequence which has at least 97% identity with the amino acid sequence set forth in SEQ ID NO: 2.

58. The isolated toxin according to claim 49 comprising an amino acid sequence which has at least 99% identity with the amino acid sequence set forth in SEQ ID NO: 2.

59. The isolated toxin according to claim 49 comprising the amino acid sequence set forth in SEQ ID NO: 2, SEQ ID NO: 12, or SEQ ID NO: 33.

60. The isolated toxin according to claim 59 comprising the amino acid sequence set forth in SEQ ID NO: 2.

61. The isolated toxin according to claim 59 comprising the amino acid sequence set forth in SEQ ID NO: 12.

62. The isolated toxin according to claim 59 comprising the amino acid sequence set forth in SEQ ID NO: 33.

63. The isolated toxin according to claim 49, where said toxin is produced by the expression of a nucleic acid molecule comprising a nucleotide sequence that has a complement that hybridizes to nucleotides 1981-2367 of SEQ ID NO: 1 in 7% sodium dodecyl sulfate (SDS), 0.5 M NaPO₄, 1 mM EDTA at 50°C. with washing in 0.1XSSC, 0.1% SDS at 65°C.

64. The isolated toxin according to claim 49, where said toxin is produced by the expression of a nucleic acid molecule comprising a nucleotide sequence that is isocoding with a nucleotide sequence having complement that hybridizes to nucleotides 1981-2367 of SEQ ID NO: 1 in 7% sodium dodecyl sulfate (SDS), 0.5 M NaPO₄, 1 mM EDTA at 50°C. with washing in 0.1XSSC, 0.1% SDS at 65°C.

65. The isolated toxin according to claim 49, wherein said toxin is produced by the expression of a nucleic acid molecule comprising a nucleotide sequence with at least 75% identity to nucleotides 1981-2367 of SEQ ID NO: 1.

66. The isolated toxin according to claim 49, wherein said toxin is produced by the expression of a nucleic acid molecule comprising a nucleotide sequence with at least 85% identity to nucleotides 1981-2367 of SEQ ID NO: 1.
67. The isolated toxin according to claim 49, wherein said toxin is produced by the expression of a nucleic acid molecule comprising a nucleotide sequence with at least 95% identity to nucleotides 1981-2367 of SEQ ID NO: 1.
68. The isolated toxin according to claim 49, wherein said toxin is produced by the expression of a nucleic acid molecule comprising a nucleotide sequence with at least 99% identity to nucleotides 1981-2367 of SEQ ID NO: 1.
69. The isolated toxin according to claim 49, wherein said toxin is produced by the expression of a nucleic acid molecule comprising nucleotides 1981-2367 of SEQ ID NO: 1 or SEQ ID NO: 3.
70. The isolated toxin according to claim 49, wherein said toxin is produced by the expression of a nucleic acid molecule comprising a nucleotide sequence with at least 93% sequence identity with SEQ ID NO: 1.
71. The isolated toxin according to claim 49, wherein said toxin is produced by the expression of a nucleic acid molecule comprising a nucleotide sequence with at least 95% sequence identity with SEQ ID NO: 1.
72. The isolated toxin according to claim 49, wherein said toxin is produced by the expression of a nucleic acid molecule comprising a nucleotide sequence with at least 99% sequence identity with SEQ ID NO: 1.
73. The isolated toxin according to claim 49, wherein said toxin is produced by the expression of a nucleic acid molecule comprising the nucleotide sequence set forth in SEQ ID NO: 1, SEQ ID NO: 3, SEQ ID NO: 11, SEQ ID NO: 32, or SEQ ID NO: 34.

74. The isolated toxin according to claim 73, wherein said toxin is produced by the expression of a nucleic acid molecule comprising SEQ ID NO: 1.
75. The isolated toxin according to claim 73, wherein said toxin is produced by the expression of a nucleic acid molecule comprising SEQ ID NO: 3.
76. The isolated toxin according to claim 73, wherein said toxin is produced by the expression of a nucleic acid molecule comprising SEQ ID NO: 11.
77. The isolated toxin according to claim 73, wherein said toxin is produced by the expression of a nucleic acid molecule comprising SEQ ID NO: 32.
78. The isolated toxin according to claim 73, wherein said toxin is produced by the expression of a nucleic acid molecule comprising SEQ ID NO: 34.
79. The isolated toxin according to claim 49, wherein said toxin has activity against a lepidopteran insect.
80. The isolated toxin according to claim 79, wherein said lepidopteran insect is selected from the group consisting of *Ostrinia nubilalis* (European corn borer), *Plutella xylostella* (diamondback moth), *Spodoptera frugiperda* (fall armyworm), *Agrotis ipsilon* (black cutworm), *Helicoverpa zea* (corn earworm), *Heliothis virescens* (tobacco budworm), *Spodoptera exigua* (beet armyworm), *Pectinophora gossypiella* (pink boll worm), *Trichoplusia ni* (cabbage looper), *Cochyles hospes* (banded sunflower moth), and *Homoeosoma electellum* (sunflower head moth).
81. The isolated toxin according to claim 49, wherein said toxin is produced by a *Bacillus thuringiensis* strain selected from the group consisting of C1674, designated NRRL accession B-30556; and C536, designated NRRL accession B-30557.
82. The isolated toxin according to claim 81, wherein said toxin is produced by *Bacillus thuringiensis* strain C1674, designated NRRL accession B-30556.

83. The isolated toxin according to claim 81, wherein said toxin is produced by *Bacillus thuringiensis* strain C536, designated NRRL accession B-30557.
84. The isolated toxin according to claim 49, wherein said toxin is produced by an *E. coli* clone selected from the group consisting of pNOV3910, designated as NRRL accession B-30553; pNOV3911, designated NRRL accession B-30552; pNOV3906, designated NRRL accession B-30555; pNOV3905, designated NRRL accession B-30554; and pNOV3912, designated NRRL accession B-30551.
85. The isolated toxin according to claim 84, wherein said toxin is produced by the *E. coli* clone designated as NRRL accession B-30553.
86. The isolated toxin according to claim 84, wherein said toxin is produced by the *E. coli* strain designated as NRRL accession B-30552.
87. The isolated toxin according to claim 84, wherein said toxin is produced by the *E. coli* clone designated as NRRL accession B-30555.
88. The isolated toxin according to claim 84, wherein said toxin is produced by the *E. coli* clone designated as NRRL accession B-30554.
89. The isolated toxin according to claim 84, wherein said toxin is produced by the *E. coli* clone designated as NRRL accession B-30551.
90. A composition comprising an effective insect-controlling amount of the toxin according to claim 49.
91. A method of producing a toxin that is active against insects, comprising:
- (a) obtaining the transgenic host cell according to claim 41;
 - (b) culturing said transgenic host cell under conditions that permit production of the toxin; and

(c) recovering said toxin.

92. A method of producing an insect-resistant transgenic plant, comprising introducing the nucleic acid molecule according to claim 1 into a plant cell; and regenerating a transformed plant from said plant cell, wherein said transformed plant is insect resistant.

93. The method of claim 92, wherein said insects are lepidopteran insects.

94. The method of claim 93, wherein said lepidopteran insects are selected from the group consisting of: *Ostrinia nubilalis* (European corn borer), *Plutella xylostella* (diamondback moth), *Spodoptera frugiperda* (fall armyworm), *Agrotis ipsilon* (black cutworm), *Helicoverpa zea* (corn earworm), *Heliothis virescens* (tobacco budworm), *Spodoptera exigua* (beet armyworm), *Pectinophora gossypiella* (pink boll worm), *Trichoplusia ni* (cabbage looper), *Cochyles hospes* (banded sunflower moth), and *Homoeosoma electellum* (sunflower head moth).

95. A method of controlling insects, comprising delivering to said insects an effective amount of the toxin according to claim 49.

96. The method of claim 95, wherein said insects are lepidopteran insects.

97. The method of claim 96, wherein said lepidopteran insects are selected from the group consisting of: *Ostrinia nubilalis* (European corn borer), *Plutella xylostella* (diamondback moth), *Spodoptera frugiperda* (fall armyworm), *Agrotis ipsilon* (black cutworm), *Helicoverpa zea* (corn earworm), *Heliothis virescens* (tobacco budworm), *Spodoptera exigua* (beet armyworm), *Pectinophora gossypiella* (pink boll worm), *Trichoplusia ni* (cabbage looper), *Cochyles hospes* (banded sunflower moth), and *Homoeosoma electellum* (sunflower head moth).

98. The method of claim 95, wherein said toxin is delivered to the insects orally.

99. A method of protecting a maize plant against at least one insect pest, comprising: introducing the nucleic acid molecule according to claim 1 in a maize cell; and regenerating a stably transformed maize plant, wherein the transformed maize plant produces an insecticidal toxin in an amount sufficient to protect the maize plant against at least one insect pest.

100. A hybrid toxin active against insects, wherein said hybrid toxin is encoded by a nucleic acid molecule comprising a nucleotide sequence according to claim 1.

101. The hybrid toxin according to claim 100, wherein said insects are lepidopteran insects.

102. The hybrid toxin according to claim 101, wherein said lepidopteran insects are selected from the group consisting of *Ostrinia nubilalis* (European corn borer), *Plutella xylostella* (diamondback moth), *Spodoptera frugiperda* (fall armyworm), *Agrotis ipsilon* (black cutworm), *Helicoverpa zea* (corn earworm), *Heliothis virescens* (tobacco budworm), *Spodoptera exigua* (beet armyworm), *Pectinophora gossypiella* (pink boll worm), *Trichoplusia ni* (cabbage looper), *Cochyles hospes* (banded sunflower moth), and *Homoeosoma electellum* (sunflower head moth).

103. The hybrid toxin according to claim 100, wherein said hybrid toxin is encoded by the nucleotide sequence set forth in SEQ ID NO: 10.

104. A composition comprising an insecticidally effective amount of the hybrid toxin according to claim 100.

105. A method of producing a hybrid toxin active against insects, comprising:

- (a) obtaining the transgenic host cell according to claim 41;
- (b) culturing said transgenic host cell under conditions that permit production of the hybrid toxin; and
- (c) recovering said hybrid toxin.

106. A method of producing an insect-resistant transgenic plant, comprising introducing the nucleic acid molecule according to claim 1 into a plant cell; and regenerating a transformed plant from said plant cell, wherein said transformed plant produces a hybrid toxin and is insect resistant.

107. The method of claim 106, wherein said insect is a lepidopteran insect.

108. The method of claim 107, wherein said lepidopteran insect is selected from the group consisting of *Ostrinia nubilalis* (European corn borer), *Plutella xylostella* (diamondback moth), *Spodoptera frugiperda* (fall armyworm), *Agrotis ipsilon* (black cutworm), *Helicoverpa zea* (corn earworm), *Heliothis virescens* (tobacco budworm), *Spodoptera exigua* (beet armyworm), *Pectinophora gossypiella* (pink boll worm), *Trichoplusia ni* (cabbage looper), *Cochyles hospes* (banded sunflower moth), and *Homoeosoma electellum* (sunflower head moth).

109. A method of controlling an insect comprising delivering to said insect an effective amount of the hybrid toxin according to claim 100.

110. The method of claim 109, wherein said insect is a lepidopteran insect.

111. The method of claim 110, wherein said lepidopteran insect is selected from the group consisting of *Ostrinia nubilalis* (European corn borer), *Plutella xylostella* (diamondback moth), *Spodoptera frugiperda* (fall armyworm), *Agrotis ipsilon* (black cutworm), *Helicoverpa zea* (corn earworm), *Heliothis virescens* (tobacco budworm), *Spodoptera exigua* (beet armyworm), *Pectinophora gossypiella* (pink boll worm), *Trichoplusia ni* (cabbage looper), *Cochyles hospes* (banded sunflower moth), and *Homoeosoma electellum* (sunflower head moth).

112. The method of claim 109, wherein said hybrid toxin is delivered to the insect orally.

113. A hybrid toxin active against insects, comprising a carboxy-terminal region of a Vip3 toxin joined in the amino to carboxy direction to an amino-terminal region of a different Vip3 toxin, wherein said carboxy-terminal region comprises an amino acid sequence which has at least 75% identity with amino acids 661-788 of SEQ ID NO: 2; and wherein said amino-terminal region has at least 85% identity with amino acids 1-660 of SEQ ID NO: 6.

114. The hybrid toxin according to claim 113, wherein said carboxy-terminal region comprises amino acids 661-788 of SEQ ID NO: 2, and wherein said amino-terminal region comprises amino acids 1-660 of SEQ ID NO: 6.

115. The hybrid toxin according to claim 113, wherein said hybrid toxin comprises amino acids 1-788 of SEQ ID NO: 12.

116. A method of controlling an insect comprising delivering to said insect an effective amount of the hybrid toxin according to claim 113.

117. The method of claim 116, wherein said insect is a lepidopteran insect.

118. The method of claim 117, wherein said lepidopteran insect is selected from the group consisting of *Ostrinia nubilalis* (European corn borer), *Plutella xylostella* (diamondback moth), *Spodoptera frugiperda* (fall armyworm), *Agrotis ipsilon* (black cutworm), *Helicoverpa zea* (corn earworm), *Heliothis virescens* (tobacco budworm), *Spodoptera exigua* (beet armyworm), *Pectinophora gossypiella* (pink boll worm), *Trichoplusia ni* (cabbage looper), *Cochyles hospes* (banded sunflower moth), and *Homoeosoma electellum* (sunflower head moth).

119. A nucleic acid molecule comprising a nucleotide sequence that encodes the hybrid toxin according to claim 113.

120. An isolated *vip3* nucleic acid molecule comprising a nucleotide sequence that:

- a) comprises SEQ ID NO: 8; or

- b) encodes the amino acid sequence set forth in SEQ ID NO: 9.